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POWDERY MILDEW DISEASE MANAGEMENT IN *HEVEA BRASILIENSIS* USING NON-SULPHUR FUNGICIDES

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Experiments were conducted to identify more efficient non-sulphur fungicides, in place of sulphur fungicides, for effective management of powdery mildew disease of mature as well as young *Hevea* rubber plants. In mature areas application of tridemorph 1.5 per cent dust was found superior to sulphur dust. Spray application of carbendazim 0.05 per cent was found to give better control than the conventional wettable sulphur. As repeated use of any systemic fungicide may lead to development of resistance to the fungicide by the pathogen, alternate use of systemic and non-systemic fungicides is suggested.

Key words – Powdery mildew disease, Disease intensity, Fungicides, Dust formulation, Disease persistence.

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INTRODUCTION

Inorganic sulphur fungicide, either as dust or wettable powder has been in use as a conventional method for the control of powdery mildew disease of rubber caused by *Oidium heveae* Steinm., in India and other rubber growing countries of the eastern hemisphere. Chemical defoliation of mature leaves, prior to natural wintering for evading the disease, was tried in Malaysia (Rao and Azaldin, 1973). This practice, however, was later discontinued due to certain practical difficulties like short duration of time for application of defoliant and nonavailability of sufficient helicopters in time (Tan and John, 1985). Low volume ground spraying of systemic fungicides in oil was recommended as an alternative to sulphur dusting in Malaysia (Lim, 1976). Fogging oil-based non-sulphur fungicide, tridemorph-in-oil, has recently gained importance for controlling powdery mildew disease in Malaysia and Brazil (Lim, 1982). Recently, in India, thermal fogging of tridemorph-in-oil was found superior to sulphur dusting (Thomson *et al*, 1984). However, frequent breakdowns and fire hazard of fogging machines prevented their widespread use. Treatments with inorganic sulphur fungicides have some limitations as these act by vaporization. Bright sunlight is required for the proper action of these fungicides. Intermittent showers and cloudy days during refoliation period make sulphur dusting ineffective (Krishnankutty and Thomson, 1987). During the past few years, many instances of complete drying of young rubber plants of 2–3 years' growth have been reported. This was due to repeated defoliation caused by powdery mildew disease during January-April and the effect of sunscorch on denuded shoots. This phenomenon was more pronounced in high ranges (above 300m) where disease persistence was observed throughout the year due to congenial climatic conditions.

The present study was aimed at identifying more effective non-sulphur fungicides for powdery mildew disease management.

EXPERIMENTAL

Experiments on mature trees :

Tridemorph (Calixin) 1.5 per cent dust formulation was dusted using a power duster in the early morning hours at the rate of 10 kg ha^{-1} $round^{-1}$ during 1986 and 1987. Control plots were dusted with 70 per cent sulphur. First round of dusting was given, depending on the time of refoliation, during January/February when about 10 per cent of the trees have bud break. Three rounds of dusting were given in 1986. During 1987, this was increased to four rounds as the refoliation was delayed due to unfavourable weather conditions. The interval between rounds was 10–15 days. The power duster was carried along every fourth row. In 1986, the experiment was conducted in the RRII Experiment Station, Kottayam on mixed clones. In 1987, the experiments were conducted in three locations *viz.*, Vaikundam Estate, Kanyakumari, Tamil Nadu (PB 86); Cheruvally Estate, Erumely, Kerala (PB 235) and Kumbazha Estate, Pathanamthitta, Kerala (PB 235).

Experiment on young rubber plants:

The experiment was laid out in randomised block design in two and a half year old GT 1 plants in a disease prone area at Mundakayam. There were ten treatments with three replications. The plot size was 0.075 ha containing 30 plants each. The details of the treatments are presented in Table 1. Four rounds of spraying were given at intervals of 15 days with high volume Rocker Sprayer during the disease season of February-March 1987. In each round, 250 ml of fungicide solution was applied per plant.

Table 1. Fungicides and dosages tried.

Treatments	Name of fungicides: Chemical Name	Common Name	Trade Name	Dosages tried (% ai)
1.	2–(Methoxy-carbamoyl) – benzimidazole	Carbendazim	Bavistin 50 WP	0.05
2.	B–([1, 1–biphenyl]–4–yloxy)– a–(1, 1–dimethyl ethyl)–1–H–1, 2, 4,–triazole – 1–ethanol.	Bitertanol	Baycor 25 WP	0.02
3.	1–(4–Chloro-Phenoxy)–3, 3–dimethyl-1-(1 H–1, 2, 4-triazol-1-yl)-2-butanone.	Triademefon	Bayleton 25 EC	0.02
4.	Dinitro (1–methyl heptyl) crotonate	Dinocap	Karathane 48 EC	0.10
5.	(N, N'–[1, 4–piperazine diyl–bis-(2, 2, 2–trichloroethylidene)]-bis-[formamide]).	Triforine	Saprol 15 EC	0.015
6.	Sandoz coded fungicide	Sandoz coded fungicide	S. 3308 12.5 WP	0.006
7.	Zinc-ione manganese ethylene bis dithio carbamate	Mancozeb	Dithane M–45 75 WP	0.20
8.	1, 2–bis (3 methoxy carboinyl-2 thioureido) benzene	Thiophanate methyl	Topsin-M 70 WP	0.035
9.	Wettable sulphur	Wettable sulphur	Sulfex 80 WP	0 20

Disease assessment:

In the dusting experiment on mature trees, disease intensity was assessed after each round of dusting as severe leaf fall occurred from the beginning. But in the spraying trial on young plants, assessment was made only by the end of the disease season as there was no regular wintering and the disease intensity was low. In both the cases, 10 trees or plants were selected at random from the middle of each plot and marked. Leaf sampling was done from these trees or plants. In both the cases, leaf samples were collected from the terminal flushes of two of the lower branches selected at random from each tree or plant. These leaves were graded at 0–4 disease scale and percentage disease intensity was calculated as per the formula of Horsfall and Heuberger (1942).

RESULTS AND DISCUSSION

The mean percentage disease intensity in the experiment plots are presented in Tables 2–4. The results indicated that tridemorph 1.5 per cent dust was superior to sulphur dust in controlling the disease on mature trees. It was observed that disease persistence was less in plots dusted with tridemorph as compared to sulphur dusted plots. The mean disease incidence in tridemorph treated trees was 65 per cent of that recorded in sulphur treated trees in 1986 when the disease intensity was high (Table 2).

Table 2. Powdery mildew intensity (%) in mature trees in 1986.

Name of Estate/Clone/ Year of planting	Fungicide	Assessment Number			Mean
		1	2	3	
RRII Experiment Station,	Tridemorph dust 1.5%	33.25	44.75	44.50	40.83
Mixed clones, 1956	Sulphur dust 70%	25.75	77.00	81.25	61.33

Table 3. Powdery mildew intensity (%) in mature trees in 1987.

Name of Estate/Clone/ Year of planting	Fungicide	Assessment Number			Mean
		1	2	3	
Vaikundam, PB 86, 1968	Tridemorph dust 1.5%	14.50	15.50	21.50	17.16
	Sulphur dust 70%	22.25	24.50	30.50	25.75
Cheruvally, PB 235, 1975	Tridemorph dust 1.5%	61.25	50.00	13.25	41.50
	Sulphur dust 70%	71.50	74.25	78.50	74.75
Kumbazha, PB 235, 1981*	Tridemorph dust 1.5%	85.50	3.50	16.25	35.08
	Sulphur dust 70%	77.75	24.25	19.25	40.41

* Treatment started after the occurrence of disease.

Table 4. Results of the spraying trial in young plants

Sl. No.	Treatment	Fungicide concentration (%)	Disease intensity (%)
1.	Carbendazim	0.05	20.91
2.	Bitertanol	0.02	25.00
3.	Triademefon	0.02	22.41
4.	Dinocap	0.10	25.16
5.	Triforine	0.015	20.33
6.	Sandoz coded fungicide	0.006	21.66
7.	Mancozeb	0.20	23.66
8.	Thiophanate methyl	0.035	24.00
9.	Wettable sulphur	0.20	22.08
10.	Unsprayed control	0.00	28.08

The results of the trial on young rubber plants (Table 4) showed that in 1987 (due to the low disease intensity in the experimental area) the differences between treatments were not significant. In a trial conducted in 1986 statistically significant maximum disease control was obtained with carbendazim (Thomson *et al*, 1987).

On repeated use of a systemic fungicide there would be chances of development of resistance in the pathogen (Dekker, 1973; Delp, 1980). As Eckert (1977) has indicated, alternate use of systemic and non-systemic fungicides only can remedy this. Eventhough, in the present study, the treatment of alternate application of systemic and non-systemic fungicides was not tested, recommending systemic fungicide alone is not, therefore, desirable. Hence, alternate use of systemic fungicide like tridemorph, carbendazim and the effective non-systemic fungicides like sulphur dust or wettable sulphur is advised for powdery mildew disease management in rubber plantations.

Considering the cost of fungicides, application of tridemorph 1.5 per cent dust is comparatively more expensive than application of 70 per cent sulphur dust. The cost of tridemorph 1.5 per cent dust required per hectare per round is about Rs. 90.00, whereas that of sulphur dust 70 per cent is Rs. 65.00. In the case of young rubber plants, the cost of fungicides per hectare per round works out to Rs. 44.00 for carbendazim and Rs. 10.00 for wettable sulphur at the dosages prescribed.

However, to avoid problems of resistance due to repeated use of systemic fungicides, alternate use of systemic and non-systemic fungicides like sulphur is beneficial especially in areas prone to high incidence of the disease.

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